

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

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NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

MR

Date of mailing
(day/month/year)

24.03.2005

Applicant's or agent's file reference
WO 21.1066

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IMPORTANT NOTIFICATION

International application No.
PCT/EP 03/13146

International filing date (day/month/year)
21.11.2003

Priority date (day/month/year)
31.12.2002

Applicant
SERVICES PETROLIERS SCHLUMBERGER et al.

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1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

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PATENT COOPERATION TREATY

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REC'D 30 MAR 2005


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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Rec'd PCT/PTO 23 JUN 2005

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| Applicant's or agent's file reference WO 21.1066 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/EP 03/13146 | International filing date (day/month/year) 21.11.2003 | Priority date (day/month/year) 31.12.2002 |
| International Patent Classification (IPC) or both national classification and IPC E21B47/08 | | |
| Applicant SERVICES PETROLIERS SCHLUMBERGER et al. | | |
| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p> | | |
| <p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p> | | |
| Date of submission of the demand 29.07.2004 | Date of completion of this report 24.03.2005 | |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized Officer Ott, S Telephone No. +49 89 2399-7429 | |



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/13146**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*):

Description, Pages

1-13 as originally filed

Claims, Numbers

1-10 filed with telefax on 07.03.2005

Drawings, Sheets

1/10-10/10 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/13146**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

| | | |
|-------------------------------|-------------|------|
| Novelty (N) | Yes: Claims | 1-10 |
| | No: Claims | |
| Inventive step (IS) | Yes: Claims | |
| | No: Claims | 1-10 |
| Industrial applicability (IA) | Yes: Claims | 1-10 |
| | No: Claims | |

2. Citations and explanations

see separate sheet

POINT V

V-1. Reference is made to the following documents:

D1: EP-A-0 657 622 (BAKER HUGHES INC) 14 June 1995 (1995-06-14)

D2: US-A-4 692 908 (EKSTROM MICHAEL P ET AL) 8 September 1987 (1987-09-08)

D3: US-A-4 665 511 (RODNEY PAUL F ET AL) 12 May 1987 (1987-05-12)

V-2. The subject-matter of claims 1 and 9 does not meet the requirements of clarity in the sense of Art. 6 PCT. It is in particular unclear what is meant by "radial" offset distance since the claims do not define a reference system such as for instance a tool with a cylindrical body (and consequently a radius). Furthermore, the second ultrasound transducer has no other technical function in claims 1 and 9 than being adjacent to the first ultrasound transducer. The travel time (t) is not clearly defined.

V-3. D1 / D2 / D3 respectively disclose:

a method for determining a velocity of ultrasound propagation in a drilling fluid in a downhole environment (D1: col.3, l.41-44 / D2: col. 7, l. 61 / D3: col.1, l.34-37), comprising:

emitting an ultrasound pulse (D1: col.6, l.52-56 / D2: col.8, l.22-25 / D3: col.5, l.61-62) into the drilling fluid in a borehole using a first ultrasound transducer (D1: 34 / D2: 76 / D3: 40);

detecting the ultrasound pulse after the ultrasound pulse has travelled through the drilling fluid a distance (D1: RTT, col.7, l.20-26 / D2: fig.5, S / D3, col.6, l.29-32); and determining the velocity of ultrasound propagation from the distance and the travel time (D1: col.8, l.44-col.9, l.3 / D2: col.7, l.64-67 / D3: col.6, l.42-52).

The subject-matter of claim 1 differs from the disclosure of D1 / D2 in that it comprises disposing a second ultrasound transducer adjacent to the first ultrasound transducer such that the front face of the first transducer is offset from the front face of the second ultrasound transducer by a predetermined radial offset distance.

D3 discloses a second ultrasound transducer (50) adjacent the first ultrasound transducer (40). The subject-matter of claim 1 therefore differs from the disclosure of D3 in that the front face of the first transducer is offset from the front face of the second ultrasound transducer by a predetermined radial offset distance (see lack of clarity in V-1.).

Due to the lack of clarity induced by the lack of a technical function of the second ultrasound transducer (see also V-1.), the subject-matter of claim 1 does not meet the requirements of inventive step in the sense of Art. 33(3) PCT, with regard to prior art D1, D2, D3.

V-4. D1 / D2 / D3 respectively also disclose:

an apparatus for determining a velocity of ultrasound propagation in a drilling fluid in a downhole environment (D1: 24 / D2: 32 / D3: 20), comprising:

a first ultrasound transducer (D1: 34 / D2: 76 / D3: 40) disposed in a tool; and circuitry (D1: 36 / D2: 88 / D3: 66) for controlling a timing of an ultrasound pulse transmitted by the first ultrasound transducer and for measuring a time lapse between ultrasound transmission and detection after the ultrasound pulse has travelled a distance (D1: col.7, l.20-26 / D2: col.8. l.22-25 / D3: col.6, l.42-52).

The subject-matter of claim 9 differs from the disclosure of D1 / D2 in that it comprises a second ultrasound transducer adjacent to the first ultrasound transducer such that the front face of the first transducer is offset from the front face of the second ultrasound transducer by a predetermined radial offset distance.

D3 discloses a second ultrasound transducer (50) adjacent the first ultrasound transducer (40). The subject-matter of claim 9 therefore differs from the disclosure of D3 in that the front face of the first transducer is offset from the front face of the second ultrasound transducer by a predetermined radial offset distance (see lack of clarity in V-1.).

Due to the lack of clarity induced by the lack of a technical function of the second ultrasound transducer (see also V-1.), the subject-matter of claim 9 does not meet the requirements of inventive step in the sense of Art. 33(3) PCT, with regard to prior art D1, D2, D3.

V-5. D1 / D2 / D3 also disclose subject-matter of claims 2, 3, 5, 8, 10 as following shows:

- 2 : D1: col.6, l.52-56 / D2: col.7, l.64-66 / D3: col.6, l.45-50.

- 3 : D3: 50.

- 5 : D3: col. 6, l.42-52.

- 8 : D1: fig.1 / D2: 32 / D3: fig.3

- 10 : D2: fig.1 / D3: fig.3

The subject-matter of claims 2, 3, 5, 8, 10 does therefore not meet the requirements of inventive step in the sense of Art. 33(3) PCT.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 03/13146

- V-6. Dependent claims 4, 6, 7 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step in the sense of Art. 33(3) PCT.
- V-7. Furthermore, D4: US-4661933, cited by the applicant (see description p.1, l.14), discloses a sonde and a method of using the sonde for measuring the propagation velocity of acoustic waves in the medium in which the sonde is immersed (p.3, l.46-61) and for accurately determining the diameter of a casing based on said velocity (col.12, l.31 col.13, l.14). The velocity is therefore not extrapolated from a velocity measurement made at the surface based on certain assumptions, but is measured "in vitro". The subject-matter of claims 1 and 9 does not either meet the requirements of inventive step in the sense of Art. 33(3) PCT, with regard to prior art D4.

Claims

- [c1] A method for determining a velocity of ultrasound propagation in a drilling fluid in a downhole environment, comprising:
- emitting an ultrasound pulse into the drilling fluid in a borehole using a first ultrasound transducer (37);
 - detecting the ultrasound pulse after the ultrasound pulse has traveled through the drilling fluid a distance (d);
 - determining a travel time (t) for the ultrasound pulse to travel the distance (d); and
 - determining the velocity of ultrasound propagation from the distance (d) and the travel time (t).
- [c2] The method according to claim 1, wherein the detecting the ultrasound pulse is performed with the first ultrasound transducer (37).
- [c3] The method according to claim 1, wherein the detecting the ultrasound pulse is performed with a second ultrasound transducer (39).
- [c4] The method according to claim 1, wherein the detecting the ultrasound pulse is performed with both the first ultrasound transducer (37) and a second ultrasound transducer (39) disposed adjacent the first transducer (37), and wherein a front face (37f) of the first ultrasound transducer (37) is offset from a front face (39f) of the second ultrasound transducer (39) by a predetermined offset distance (ΔD_f).
- [c5] The method according to claim 4, further comprising determining a borehole diameter (D_{bh}) using the predetermined offset distance (ΔD_f) and a difference in travel times ($T_2 - T_1$) for the ultrasound pulse to be detected by the first ultrasound transducer (37) and the second ultrasound transducer (39).
- [c6] The method according to any of claims 1-3, wherein the drilling fluid is located in a mud channel in a tool.

- [c7] The method according to claim 6, wherein said first and second transducers are located on opposite sides of the mud channel in the tool.
- [c8] The method according to claim 1, wherein a second ultrasound transducer (39) is disposed adjacent the first ultrasound transducer (37) such that a front face (37f) of the first ultrasound transducer (37) is offset from a front face (39f) of the second ultrasound transducer (39) by a predetermined offset distance (ΔD_f), wherein the detecting the ultrasound pulse is performed by the first ultrasound transducer (37), and wherein the method further comprises:
- emitting a second ultrasound pulse into the drilling fluid in the borehole using the second ultrasound transducer (39); and
 - detecting the second ultrasound pulse after the second ultrasound pulse has traveled through the drilling fluid a distance ($d + 2\Delta D_f$) using the second ultrasound transducer (39).
- [c9] The method according to claim 8, wherein the ultrasound pulse and the second ultrasound pulse are emitted simultaneously.
- [c10] The method according to any of claims 1-5 or 8, wherein the drilling fluid is located in an annulus between a tool and a borehole wall.
- [c11] An apparatus for determining a velocity of ultrasound propagation in a drilling fluid in a downhole environment, comprising:
- a first ultrasound transducer (37) disposed on a tool; and
 - circuitry (82) for controlling a timing of an ultrasound pulse transmitted by the first ultrasound transducer (37) and for measuring a time lapse between ultrasound transmission and detection after the ultrasound pulse has traveled a distance (d).
- [c12] The apparatus according to claim 11, further comprising a second ultrasound transducer (39).

- [c13] The apparatus according to claim 12, wherein the first ultrasound transducer (37) and the second ultrasound transducer (39) are disposed across a drilling fluid channel inside the tool.
- [c14] The apparatus according to claim 12, wherein the first ultrasound transducer (37) and the second ultrasound transducer (39) are disposed on an outside surface of the tool.
- [c15] The apparatus according to claim 12, wherein the first ultrasound transducer (37) and the second ultrasound transducer (39) are disposed adjacent each other on a tool surface, and wherein a front face (37f) of the first ultrasound transducer (37) is offset from a front face (39f) of the second ultrasound transducer (39) by a predetermined distance (ΔD_f).